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(56) Documents Cited
GB 2090734 A GB 2059256 A US 4777679 A
US 4347633 A US 4267611 A

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UK CL (Edition O) A4M
INT CL^6 A47C, A61G
ONLINE DATABASE:WPI

(54) Inflatable pad for bedridden patients

(57) A pressure pad 3 suitable for prevention and management of bed sores comprises at least two sets of interleaved alternately inflatable cells 1, 2, each cell extending transversely across the pad and defining a non-linear, non repeating path e.g. a sinusoidal or U- or V-shaped path centred on the pad. Sets of further cells 13, 14 inflated at constant pressure may be provided below opposite ends of the transverse cells and arranged to lie longitudinally of the pad. Longitudinal cells at each side may be arranged adjacent each other and of successively decreasing diameter in order to provide an optimum curved surface.

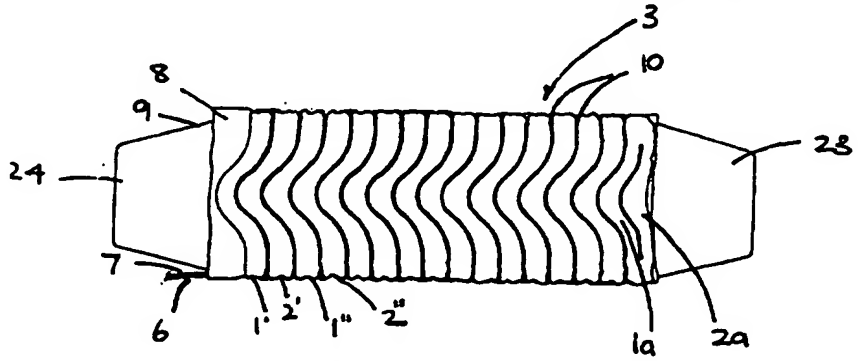

Fig 1.

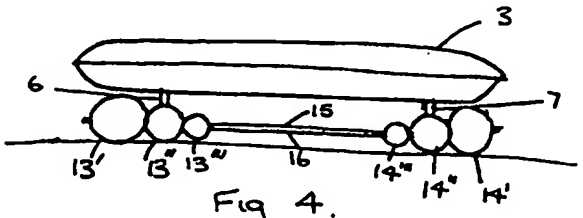

Fig 4.

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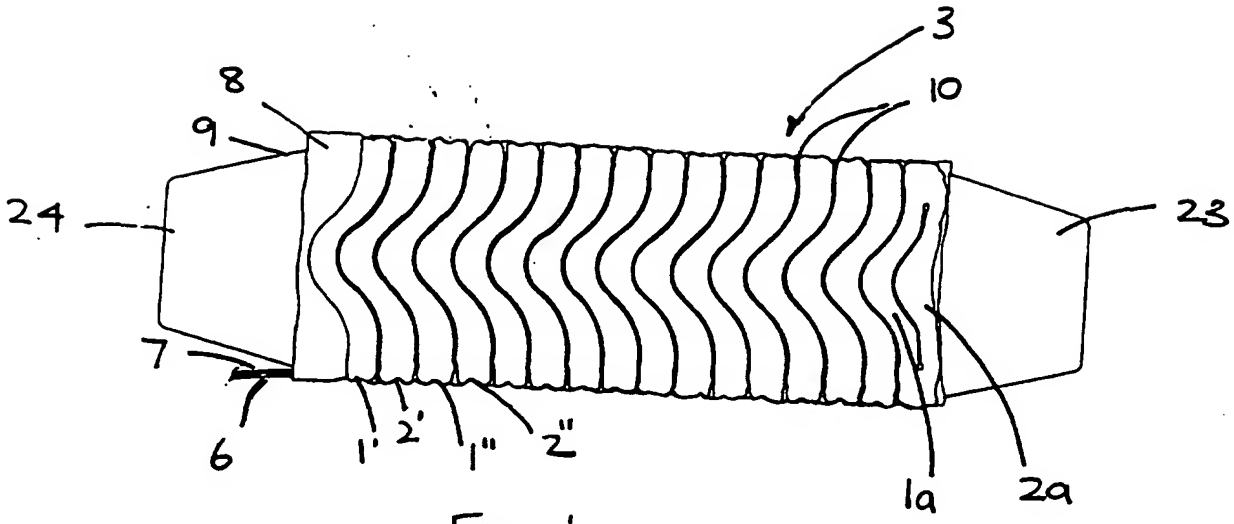

Fig 1.

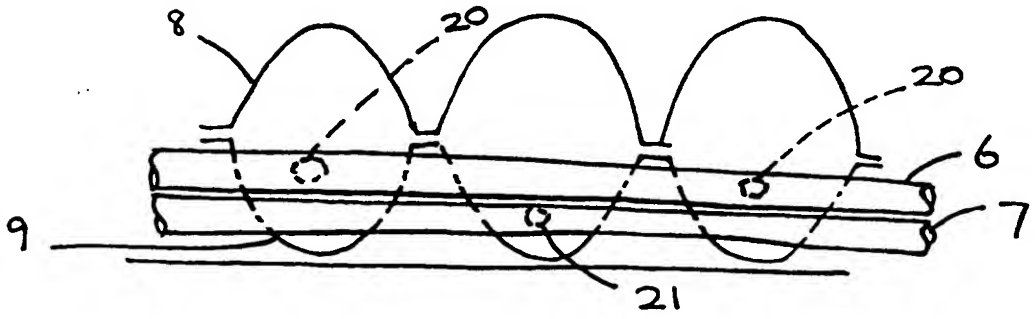

Fig 2.

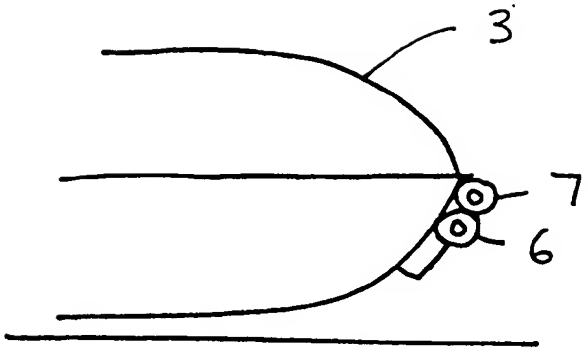

Fig 3.

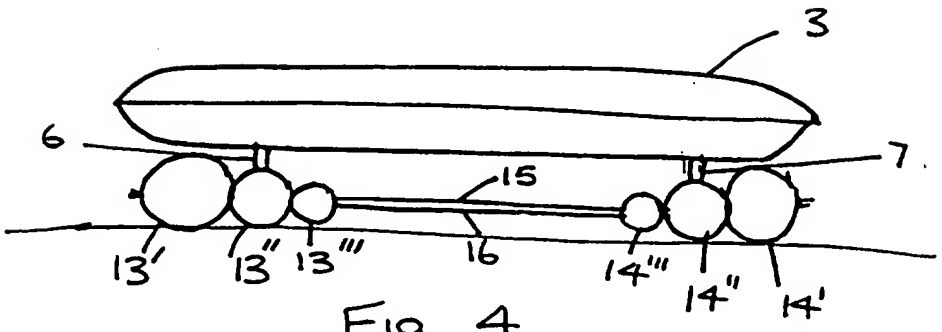

Fig 4.

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ALTERNATING PAD

This invention relates to alternating pressure pads, and in particular to alternating pressure pads of the kind used in the prevention and management of decubitous ulcers in bedridden patients.

The formation of decubitous ulcers, commonly known as bed sores, results from, amongst other things, the pressure applied to certain portions of the skin of a bedridden patient. It is known to meet the requirement for the prevention and management of decubitous ulcers with an alternating pressure pad comprising two series of alternatively inflatable cells which are interleaved, one series within the other. The cells are alternately inflatable to support a patient at different locations. Typically, inflation and deflation cycles may last from under two minutes for a gentle massaging effect to over twenty minutes.

Patient comfort dictates that support provided by a given region of a pad is not affected by the pressure applied by a patient to adjacent regions. Therefore, a pad of small cells is more comfortable to the patient than a pad of large cells, and a pad comprising small cells in a zig-zag or T-shape or similar path across the pad provides optimum comfort.

However, these small cell pads are unable to support the heavier patients or the larger bony protuberances of even relatively light patients unless pressurised to an uncomfortably high support pressure.

Consequently, in order to provide sufficient support it has been found necessary to use pads with large cells which inflate to a greater thickness and at a lower, more comfortable pressure. Typically, large cells have been used in the form of an elongate cylinder extending linearly straight across a pad. However, these pads have experienced problems of large areas of the body being left unsupported, or the areas supported feeling uncomfortable leading to patient discomfort and uneasiness. The cells have also been unable to prevent bony protuberances falling between the inflated cells and resting on the mattress beneath, or bottoming of the patient in the semi-recumbant position where the cells are prone to separate out under the patient's sacrum.

Reconciling the advantages of small cells to large cells has hitherto been accomplished by providing double layer small cell pads or smaller diameter cells under the heels of the patient.

The present invention seeks to provide an improved large cell alternating pressure pad.

In accordance with the present invention, an alternating pressure pad comprises at least a first and a second series of alternately inflatable cells, which are interleaved, one series within the other, each cell extending transversely across the pad and defining a non-linear, non-repeating path wherein substantially all of the cells define the same path.

The non-linear path of the cells provides a greater length of each cell in contact with the body with improved comfort since more of the patient is supported at any one time. We have found that due to the increased contact area a lower average interface

pressure is achieved than that achieved with pads having the conventional linear transverse arrangement of such cells.

According to another aspect of the invention, an alternating pressure pad comprises alternately inflatable transverse cells including at least one longitudinal cell underlying each opposite end of the transverse cells, the longitudinal cells inflated at constant pressure. The longitudinal cells extend along the length of the pad and, in use, a surface which curves around a patient lying thereon is provided such that the area of the patient supported at any one time is increased, the increased contact area resulting in lower interface pressures and improved comfort for the patient.

In the preferred embodiment the cells define a sinusoidal path.

Preferably, each cell path defines substantially a U-shape located centrally of the pad. The location of the U-shape centrally of the pad provides a two-dimensional and hence greater pressure distribution, the patient being supported across the back by the central curve of the U-shape and also supported along the sides of the body by the arms of the U-shaped cell.

Preferably, the arrangement of cells in their respective series along the length of the pad comprises the central curve of the U-shape of one cell path in a series corresponding horizontally with the tops of the arms of the U-shape of the next following cell path in the same series. This unique profile of the cells paths provides an advantageous overlap effect which ensures that the support to the patient is maintained and reduces the likelihood of the patient bottoming and coming to rest on the

mattress beneath, especially in the semi-recumbant position. The unique profile further reduces the likelihood of the patient sliding down the pad, a problem normally encountered with the conventional transverse linear celled alternating pads.

Preferably, the cell path may define a V-shape centrally of the pad.

Preferably, the cell(s) for supporting the head of a patient are inflated at constant pressure, to avoid uncomfortable pad induced head movement.

Preferably, the alternately inflatable cells are inflated simultaneously. The simultaneous inflation of all the cells provides a static pad to provide constant support.

Preferably, manifolds and cell connections for feeding fluid to the cells are located beneath the pad on the outer curved ends of the transverse cells, providing a larger unimpeded patient support area. Preferably, the longitudinal cells may comprise the manifolds for feeding fluid to the transverse cells.

Preferably, there are a plurality of longitudinal cells arranged adjacent to each other in a direction inwardly of the pad and more preferably the cells are each of decreasing diameter than the outer adjacent cell, for improved 'cradle' effect.

Preferably, a sensor is arranged to be located beneath the pad and disposed inbetween the longitudinal cells, the sensor being further connected to the manifolds for fluid to flow through the sensor to exhaust, the sensor reducing the air flow to exhaust from each of manifolds during inflation of the corresponding

series of transverse cells if the pad is insufficiently inflated to support a patient thereon. In this way optimal patient support pressure is provided.

It will also be apparent that although the present invention will find substantial applications as a form of mattress or overlay, it may also be modified for use in a wide variety of other applications, for instance on seats and particularly wheelchair seats.

Examples of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an embodiment of an alternating pressure pad according to the invention;
Figure 2 shows the arrangement of the manifolds suitable for feeding fluid to the cells in Figure 1;
Figure 3 is a cross-sectional view of the manifolds in Figure 2;
Figure 4 is a schematic view of another aspect of an alternating pressure pad according to the invention;

Referring now to Figure 1, the alternating pressure pad includes a first series of cells 1 formed by alternate cells 1', 1'', etc., and a second series of cells 2 formed by cells 2', 2'', etc., the two series interleaved to form a pad 3. The two series of cells 1 and 2 are alternately inflatable and are supplied with air from a compressor feeding a rotary valve. The first and second series are supplied air from respective manifolds 6 and 7. It is envisaged that cells in series of three or more may also be used or that more than one cell in any one series may be inflated alternately. Generally, the cells are shaped as

elongate cylinders which in the preferred embodiment extend transversely across the pad along a sinusoidal path.

The cells may be individually formed and restrained onto a base sheet along a sinusoidal path to form the alternating pressure pad or in accordance with the preferred embodiment, the alternating pressure pad may be made from top 8 and bottom 9 sheet material welded together to define alternately inflatable cells. The alternating pressure pad may also comprise sections made from top 8 and bottom 9 sheet material welded together to define alternately inflatable cells. The welds 10 define the sinusoidal path transversely of the pad.

The series of cells are supplied with fluid by manifolds 6 and 7 which run along the side of the cells. Two such manifolds are shown in Fig. 2, one manifold feeding each series of cells. The manifolds 6 and 7 are connected to the series of the cells by connectors 20 and 21. Connectors 20 are located at positions along the manifold 6 to feed fluid to one series of cells and connectors 21 are located at positions along manifold 7 to feed fluid to the other series of cells. As shown in Fig. 3, both the connectors and manifolds are located on the curved ends of the cells to provide a larger unimpeded area for the patient to lie on. The two head section cells 1a and 2a are connected to the respective manifolds via one-way valves so that the cells retain a constant pressure throughout the inflation and deflation cycles of the rest of the cells.

In another aspect of the invention, an alternating pressure pad additionally comprises longitudinal cells 13 and 14 underlying the alternating inflatable transverse cells in a pad. The transverse cells may be as shown in Fig. 1 or any other form

available in the art. The longitudinal cells 13 and 14 extend the length of the pad and support the pad at opposite sides thereof. The longitudinal cells are at constant pressure and when inflated provide a surface which curves around a patient lying thereon, giving a desirable cradling feeling to the patient.

Referring now to Fig. 4, in a preferred embodiment, the longitudinal cells may be made from top 15 and bottom 16 sheet material of the same length and width as the pad material 8,9 and welded together to form respectively three interconnected longitudinal cells 13',13'',13''' and 14',14'',14'''at the opposite sides. The longitudinal cells at each side are arranged adjacent each other and of successively decreasing diameter size in order to provide an optimum curved surface when a patient is lying thereon.

The longitudinal cells can be connected to the pad and inflated in various ways. In the preferred embodiment, in Fig. 4, one each of the longitudinal cells 13'' and 14'' comprise the manifolds themselves, each connecting along their lengths with respective transverse cells to feed fluid thereto and both feeding fluid to the other longitudinal cells 13', 13''', 14', 14'''. Similarly, only one longitudinal cell may be arranged to comprise connectors at either side thereof with a separating weld between the two sets of connectors feeding the respective transverse cells and both the connectors feeding the or other longitudinal cells.

Alternatively, the manifolds 6 and 7 in Fig. 2 may comprise additional connectors 20 and 21 both connecting the or each longitudinal cell.

Additionally, the top 15 and bottom 16 sheets may further define a sensor pad in between the longitudinal cells 13 and 14. The sensor pad is described in our patents GB2233551 and GB2258808 and is hereby incorporated by reference.

The alternating pressure pads according to the invention also include flaps 23 and 24 extending from each head and foot sections of the pad to secure the pad onto a mattress on a bed.

CLAIMS

1. An alternating pressure pad comprising at least a first and a second series of alternately inflatable cells which are interleaved, one series within the other, each cell extending transversely across the pad and defining a non-linear, non-repeating path wherein substantially all of the cells define the same path.

2. An alternating pressure pad comprising alternately inflated transverse cells which are interleaved including at least one longitudinal cell underlying each opposite end of the transverse cells, the longitudinal cells being inflated at constant pressure.

3. An alternating pressure pad as claimed in claim 1 or 2 wherein the transverse cells define a sinusoidal path.

4. An alternating pressure pad as claimed in claim 3 wherein each cell path defines substantially a U-shape located centrally of the pad.

5. An alternating pressure pad as claimed in claim 4 wherein the arrangement of cells in their respective series along the length of the pad comprises the central curve of the U-shape of one cell path in a series corresponding horizontally with the tops of the arms of the U-shape of the next following cell path in the same series.

6. An alternating pressure pad as claimed in claims 3 wherein the cell path defines a V-shape centrally of the pad.

7. An alternating pressure pad as claimed in any preceding claim wherein the transverse cell(s) for supporting the head of a patient are inflated at constant pressure.

8. An alternating pressure pad as claimed in any preceding claim wherein the transverse alternately inflatable cells are inflated simultaneously.

9. An alternating pressure pad as claimed in any preceding claim comprising manifolds and cell connections for feeding fluid to the cells, the manifolds and cell connections located beneath the pad on the outer curved ends of the transverse cells, providing a larger unimpeded patient support area.

10. An alternating pressure pad as claimed in any one of claims 2 to 9 wherein the longitudinal cells comprise the manifolds for feeding fluid to the cells.

11. An alternating pressure pad as claimed in any one of claims 2 to 10 wherein a plurality of longitudinal cells are arranged adjacent to each other in a direction inwardly of the pad.

12. An alternating pressure pad as claimed in claim 11 wherein the cells are each of decreasing diameter than the outer adjacent cell, for improved 'cradle' effect.

13. An alternating pressure pad as claimed in any one of claims 2 to 12 wherein a sensor is arranged to be located beneath the pad and disposed inbetween the longitudinal cells, the sensor being further connected to the manifolds for fluid to flow through the sensor to exhaust, the sensor reducing the air flow to exhaust from each of manifolds during inflation of the

corresponding set of transverse cells if the pad is insufficiently inflated to support a patient thereon.

14. An alternating presure pad substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Patent Office

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Application No:	GB 9624718.4	**Examiner:**	John Graham
Claims searched:	2-14	**Date of search:**	16 April 1997

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A4M

Int Cl (Ed.6): A47C. A61G.

Other: ONLINE DATABASE:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1599422	(GLYNWED) see longitudinal cell12	2 at least
X	WO 95/21599	(STACY) see Fig 3 transverse cells 94 and longitudinal cells 78,80,82	"
X	US 4777679	(DELOOPER) see Fig 9 and related description	"

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Patent Office

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Application No: GB 9624718.4 **Examiner:** John Graham
Claims searched: 1,3-14 **Date of search:** 18 February 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A4M

Int Cl (Ed.6): A47C. A61G.

Other: ONLINE DATABASE:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2090734 A	(OLIVELARK) see eg Fig 1	1,3-5,8
X	GB 2059256 A	(HUNTLEIGH) see eg Fig 1	1,4,8,
X	US 4777679	(DELOOPER) see eg Fig 9	1,3-5,8,
X	US 4347633	(GAMMONS) see eg claim 22	1,4-6,8
X	US 4267611	(AGULNICK) see eg Fig 1	1,3-5,8,9,12,

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.